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FOREST SURVEY RELEASE NO. 27 July 31, 1937

FOREST RESOURCES OF SOUTHWEST ARKANSAS

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A Progress Report

by

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

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SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

INDEXED

FOREWORD

The nation-wide Forest Survey, being made by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

This release contains Forest Survey data that will be included in complete reports to be published later. It should therefore be regarded as a progress report. Although considered reliable, the data are subject to correction or amplification as the work of computation proceeds.

Staff Assignment

In Charge of Field Work and Preparation of Report
James W. Cruikshank - Associate Forest Economist

In Charge of Computations
P. R. Wheeler - Associate Forest Economist

FOREST RESOURCES OF SOUTHWEST ARKANSAS

General Description of the Unit

This report deals with the forest resources in that portion of Arkansas lying west of the alluvial delta of the Mississippi River and south of the Ouachita Mountains. This area of 8,931,900 acres comprises 18 counties and parts of 4 others. Texarkana and Pine Bluff are the two largest cities in the Unit, but much of the business activity affecting the Unit centers in Little Rock, which is a short distance northeast of the Unit boundary. Approximately 68 percent of the land surface of the Unit supports some kind of forest growth; and agriculture and forest industries are the chief activities, although the petroleum industry is important in certain localities. Shortleaf and loblolly pines in mixture with hardwoods are the predominating forest trees of the region.

The Ouachita Mountains, which occur along the northern edge of the Unit, have elevations as high as 2,340 feet. South of these mountains lies the Athens Plateau, which gradually merges into the Gulf Coastal Plain, a rolling country that slopes gently toward the South and varies in elevation from 200 to 400 feet above sea level. About 90 percent of the Unit is in this Coastal Plain. Drainage is adequate; at times, it is even excessive. The Red and the Ouachita Rivers with their tributaries drain the western and central portions of the Unit, while the extreme eastern tier of counties is drained by Bartholomew Bayou. All these streams flow south or southeast.

The Unit is covered with a network of railroads. Several main-line systems with numerous, secondary feeder roads provide adequate railroad transportation within the Unit and to outside points. Main highways are few, but many of the secondary roads are suitable for all-weather travel. Water transportation is limited to barge service on the Ouachita River as far north as Camden. Numerous pipe lines transport crude oil from the Eldorado field to refineries, while two gas companies have lines distributing natural gas to the larger towns.

In 1930 the population was 459,000, or 22.5 percent more than in 1910. Only 21 percent of the people live in towns of 2,500 or more; the remainder live on farms or in small communities adjacent to wood-working plants. Agriculture is the chief occupation of 57 percent of the people; forest industries employ 7 percent; and all other industries, 36 percent. Forest industries have a greater importance than these percentages signify, however, because a large proportion of the farm operators are employed part-time in the harvesting or manufacture of forest products.

Agriculture is the most important industry in the Unit. According to the census of 1935, there were nearly 60,000 farms in the Unit containing approximately 4 million acres of land. The average farm contains 67.2 acres, of which 27.6 acres are woodland. There has been an increase of 2.1 percent in the number of farms since 1930 and an area increase of about 400,000 acres. Most of this increased area is woodland which has not yet been cleared, as land available for crops increased only 60,000 acres. The Forest Survey shows about 274,000 acres of agricultural land standing idle and almost 150,000 acres

that have been definitely abandoned for agricultural-crop production. Diversified farming is generally practiced, although specialized truck and orchard crops are important sources of income in certain localities.

The largest proportion of land area is in farms, the combined acreage totalling about 45 percent of the Unit. This acreage is cultivated by 60,000 operators, 43 percent of whom are sole or part owners of their land, while the remainder are croppers or tenants. Available records show that 2,000,000 acres of forest land, or over 20 percent of the total area of the Unit, are owned by 20 companies, the majority of which are operating sawmills; but large acreages are controlled by a few land-holding and paper-mill companies. The largest individual ownership recorded is 560,000 acres, while there are several of over 100,000 acres.

Tax delinquency is less in this section of Arkansas than in the Delta and mountain regions of the State. Only 3.4 percent of the gross land area in the Unit had been tax delinquent for at least 3 years on July 1, 1934.

The distribution of the land area of the Unit, according to the classes of land use recognized by the Survey, is shown in table 1.

Table 1. - Land area classified according to land use

Land use	Area		Percent of total area
	- - - - Acres - - - -		
Forest:			
Productive	6,097,900	68.3	
Nonproductive	7,300	0.1	
Total forest	6,105,200		68.4
Nonforest:			
Agricultural:			
In cultivation:			
Old cropland	1,813,900	20.3	
New cropland	59,600	0.7	
Out of cultivation:			
Idle	273,700	3.0	
Abandoned	148,900	1.7	
Pasture	329,300	3.7	
Total agricultural	2,625,400	29.4	
Other nonforest	201,300	2.2	
Total nonforest areas	2,826,700		31.6
Total forest and nonforest	8,931,900		100.0

AREAS CHARACTERIZED BY MAJOR FOREST TYPES IN SOUTHWESTERN ARKANSAS

PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
FROM DATA COLLECTED 1936

FOREST TYPES

- 7 SHORTLEAF-HARDWOODS
- 8 SHORTLEAF-LOBLOLLY-HDWDS.
- 9 LOBLOLLY-HDWDS.
- 11 MIXED UPLAND HDWDS.
- 13 MIXED BOTTOMLAND HDWDS.
- PRAIRIE

TYPE SYMBOLS INDICATE AREAS WHERE THE GIVEN TYPE PREDOMINATES, BUT THE FREQUENT LOCAL OCCURRENCE OF OTHER TYPES IS NOT PRECLUDED.

STATUTE MILES
10 0 10 20

LOCATION OF AREA IN THE STATE OF ARKANSAS

94° 93° 92°

OKLAHOMA
TEXAS
LOUISIANA

SEVIER
HOWARD
PIKE
LITTLE RIVER
HEMPSTEAD
NEVADA
OUACHITA
CLARK
HOT SPRING
GARLAND
MONTGOMERY
POLK
MILLER
LAFAYETTE
COLUMBIA
UNION
DALLAS
GRANT
JEFFERSON
CLEVELAND
LINCOLN
DREW
ASHLEY
CALHOUN
BRADLEY

UMPIRE
GLENWOOD
ROSEBORO
DE ROCHE
MALVERN
SHERIDAN
PINE BLUFF
DIERKS
DEQUEEN
MURFREESBORO
ARKADELPHIA
DONALDSON
TULIP
CARTHAGE
MANNING
PRINCETON
RISON
STAR CITY
DELIGHT
OKOLONA
NASHVILLE
GURDON
SPARKMAN
HOLLY SPRINGS
FORDYCE
KINGSLAND
MINERAL SPRINGS
WASHINGTON
PRESCOTT
CHIDESTER
BEARDEN
EAGLE MILLS
NEW EDINBURG
ASHDOWN
McNAB
HOPE
BODCAW
PATMOS
GLENVILLE
CAMDEN
SMEAD
TINSMAN
WARREN
WILMAR
MONTICELLO
BANKS
HAMPTON
TEXARKANA
OGAMAW
STEPHENS
HERMITAGE
LEWISVILLE
WALDO
MT. HOLLY
CALION
MAGNOLIA
EL DORADO
HAMBURG
KERLIN
TAYLOR
EMERSON
ATLANTA
URBANA
CROSSETT
HUTTIG
ARKANSAS CITY
LAKE VILLAGE

LITTLE ROCK

RED RIVER
MISSISSIPPI RIVER
OUACHITA RIVER
SALINE RIVER
CHICOT RIVER
ROCK ISLAND
MISSOURI & NORTHWESTERN
KANSAS CITY SOUTHERN
LITTLE RIVER
GALATIA
EASTERN
PACIFIC
ST. LOUIS-SAN FRANCISCO
ST. L. S. W.
MISSOURI PACIFIC
LOUISIANA & ARKANSAS
ST. LOUIS SOUTHWESTERN
T. & P.
CRI & P
M. P.
M. & O.
ASHLEY DREW & NORTHERN
A. & L. M.

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Description of the Forest

Over 68 percent of the forest area is in rolling uplands; 16 percent is in river bottoms; and the remainder is distributed among swamps and poorly drained benches. Broadly speaking, the forests of the Unit can be classified either as mixed-pine-hardwoods or as pure hardwoods. Most common are the second-growth stands of shortleaf and loblolly in mixture with various hardwoods. In general there is a larger proportion of loblolly in the southern part of the Unit than along the foothills of the Ouachita Mountains, where shortleaf mixed with hardwoods is the usual association. Along the rivers and in many of the smaller stream-bottoms is found the bottomland hardwood type, made up principally of red and black gums, red and white oaks, cypress, and ash. Stands of red gum, post oak, hickory, and a few pines form the upland hardwood type, which occurs in scattered patches throughout the pine stands.

Table 2. - Forest area classified according to forest condition and forest type-group

Forest condition	Forest type-group				Total all types	Percent of total
	Pine	Pine hardwoods	Upland hardwoods	Bottomland hardwoods		
	Acres 1/					
Old growth:						
Uncut	48,300	30,600	58,800	189,200	326,900	5.3
Partly cut	35,500	65,200	87,700	292,200	480,600	7.9
Total	83,800	95,800	146,500	481,400	807,500	13.2
Second growth:						
Sawlog size:						
Uncut	1,247,100	645,700	155,400	359,900	2,408,100	39.5
Partly cut	557,900	537,000	144,900	185,200	1,425,000	23.4
Under sawlog-size	289,900	463,700	336,600	237,500	1,327,700	21.8
Reproduction	5,600	29,800	82,100	12,100	129,600	2.1
Total	2,100,500	1,676,200	719,000	794,700	5,290,400	86.8
Total all conditions	2,184,300	1,772,000	865,500	1,276,100	6,097,900	100.0
Percent of total forest area	35.8	29.1	14.2	20.9	100.0	

1/ Area in clear-cut and fire-killed condition is negligible.

The pure pine types and the pine-hardwoods together cover 65 percent, or nearly 4 million acres, of the forest area, and collectively make up the shortleaf-loblolly-hardwood association. In the pure pine stands, the pines make up nearly 84 percent of the net cubic volume in the type, while in the pine-hardwoods, the pine component is only 52 percent of the net cubic volume. The bottomland-hardwoods are most fully developed in the bottoms along the Red, Ouachita, and Saline Rivers, although the smaller streams flowing through deposits of recent alluvium are generally bordered by this type. As a result, such stands are often widely scattered in "stringers" along the streams rather than in continuous tracts. The total acreage of bottomland hardwoods in the Unit is about $1\frac{1}{4}$ million acres, or 21 percent of the forest area. The upland hardwoods generally occur in the rolling lands and often in small, scattered patches; the most extensive area lies north of Monticello and east of Rison. In limited areas, the hardwoods are so stunted and of such poor quality that they are classified as scrub hardwoods. The total area of these scrub stands amounts to less than 30,000 acres. The combined acreage of the upland and scrub hardwoods is 865,500 acres, or 14 percent of the forest land.

As shown in table 2, about 13 percent of the total forest area is old-growth, over half of which, or 481,400 acres, is in bottomland hardwoods. The advanced stage of restocking since the removal of the original timber is indicated by the presence of sawlog-size second-growth stands averaging 35 to 45 years of age on 62.9 percent of the total forest area. Young stands under sawlog-size occur on 21.8 percent, and reproduction on 2.1 percent of the forest area, while the clear-cut acreage is negligible.

Volume Estimates

Board-foot volume

In the estimate given in table 3, the stand of sound sawlog-size trees is expressed in terms of board feet, as measured by the Doyle log-rule. The volumes are net log scale, that is, allowance has been made for material that would be left in the woods because of rot, fire-scar, crook, limbiness, and similar defects, as well as for loss in sawing at the mill due to sweep and hidden defects. Volume was included to the upper limit of usable material in the tops rather than to a fixed top diameter, but no pine logs less than 5.5 inches in diameter at the small end nor any hardwood logs less than 8.5 inches were included. The sawlog-size trees included in the volume estimate must contain at least one sound 12-foot butt log, or 50 percent of the gross volume of the tree must be sound material. In addition, hardwoods must have a minimum d.b.h. outside bark of 13 inches, and pines, of 9 inches.

Table 3 shows that the total board-foot volume by the Doyle rule is 12-1/3 billion feet. Practically all of this volume is so located as to be physically accessible for logging. Nearly 87 percent of the forest area supporting this stand is stocked with a second crop of timber standing over the stumps left in logging the original old growth. Availability for cutting, however, depends on the volume per acre and quality of the stand as well as on accessibility. Some of the stands are too light to allow immediate logging, but it must be understood that the utilization of this forest, under any circumstances, will be spread over a considerable length of time and that the natural growth of trees is continually increasing the number, size, and volume of trees in these stands. In 1936 the inventory showed that 10 of the 12-1/3 billion feet of sawtimber was located in stands that averaged 3,000 feet per acre, all of which contained more than 600 feet per acre.

Pines account for 54.6 percent of the total volume, and hardwoods for 45.4 percent. Loblolly is the leading pine component of the stand, while red oak and red gum are the most abundant hardwoods. Although the volume of hickory is small compared with that of other hardwoods, the 288½ million board feet of hickory are the basis for an important handle industry in southwest Arkansas.

Table 3. - Net volume (Doyle) classified according to species group and forest condition

Species group	Old growth		Second growth		Total	Percent of total
	Uncut	Partly cut	Sawlog size	Under sawlog size 1/		
	- - - - - - - - Thousand board feet - - - - - - - -					
Pines:						
Shortleaf	193,400	145,700	2,053,100	29,600	2,421,800	19.7
Loblolly	434,600	197,800	3,632,500	33,100	4,298,000	34.9
Total pines	628,000	343,500	5,685,600	62,700	6,719,800	54.6
Pulping hardwoods:						
Red gum	346,500	231,200	742,900	10,200	1,330,800	10.8
Black gum	55,600	113,100	189,500	6,300	364,500	3.0
Others	57,800	79,800	83,300	2,500	223,400	1.8
Nonpulping hardwoods:						
Red oaks	324,500	329,200	901,000	21,300	1,576,000	12.8
White oaks	293,900	157,500	363,400	9,000	823,800	6.7
Post oak	62,300	75,800	268,900	9,500	416,500	3.4
Hickory	46,600	70,300	163,100	8,500	288,500	2.3
Ash	14,200	18,600	28,900	3,300	65,000	.5
Others	139,500	142,600	212,800	8,500	503,400	4.1
Total hardwoods	1,340,900	1,218,100	2,953,800	79,100	5,591,900	45.4
Total all species	1,968,900	1,561,600	8,639,400	141,800	12,311,700	100.0
Percent of total	16.0	12.7	70.1	1.2	100.0	

1/ Includes areas classified as reproduction; clear-cut areas are negligible.

For the Unit as a whole, 28.7 percent of the total board-foot volume occurs in the old-growth condition. Consideration of the pine and hardwood volumes separately reveals only 14.5 percent of the total pine-volume in the old-growth condition as contrasted with 45.8 percent of the hardwood volume. In the old-growth uncut pure pine types, the average stand per acre is 13,600 feet (lumber tally), of which 13,000 is pine. In the old-growth pine-hardwood types, the average stand is 9,900 feet per acre, of which 6,300 feet is pine. In the old-growth uncut bottomland hardwood type, the average stand per acre is 7,300 feet, practically all of which is in hardwoods.

Second-growth pine and pine-hardwoods are the predominating forest stands in southwestern Arkansas. Occupying 61.9 percent of the forest area, this young forest contains 63.7 percent of the total sawtimber volume. At present the second-growth uncut stands of sawlog size in the pure pine types average 5,100 feet (lumber tally) per acre, of which 4,800 feet is pine. Bottomland hardwood stands of similar forest conditions average 3,400 feet per acre, principally pure hardwoods. The upland hardwood second-growth stands of sawlog size average 2,200 feet per acre, of which 200 feet is pine.

Although the Doyle log-rule is the legal rule of Arkansas and is in general use for timber estimates in the South, its application to stands made up mainly of small trees results in a very considerable understatement of the actual recoverable volume. Since the International $\frac{1}{4}$-inch rule closely approximates green lumber tally, in the following table the volumes are measured according to it, in order to give a more accurate expression of the amount of sawtimber present.

Table 4. - Net volume by International $\frac{1}{4}$-inch rule classified according to species group and forest condition

Forest condition	Pines	Red and black gums, etc.	Red and white oaks, etc.	Total
	- - - - - - - - - Thousand board feet - - - - - - - - -			
Old growth:				
Uncut	870,500	577,100	1,092,600	2,540,200
Partly cut	531,500	576,200	1,019,900	2,127,600
Second growth:				
Sawlog size	10,260,200	1,467,600	2,671,600	14,399,400
Under sawlog size 1/	142,800	30,600	91,900	265,300
Total all conditions	11,805,000	2,651,500	4,876,000	19,332,500

1/ Includes reproduction; clear-cut acreage is negligible.

Cordwood volume

In estimating the cordwood volume, the entire stand of good trees at least 5 inches d.b.h., outside the bark, is expressed in terms of standard (4 x 4 x 8 feet) cords. It should be understood that sawlog-size trees which have been covered in the estimate of board-foot volume are also included in this estimate. In addition, in table 5 only, an estimate of the net sound material in cull trees is included. The volume shown in the column "Sound trees sawlog size" in this table includes only the cordwood in the merchantable sawlog portion of the stems of sound trees. That part of the stem above the sawlogs (i.e., the upper stems) taken to a variable diameter, but not to less than 4 inches, is given under "Tops of sawlog-size trees." In this volume the stem only is included in pines, but in the hardwoods the usable limbs are also included to a 4-inch diameter. In the column "Sound trees under sawlog size," the full stems of both pines and hardwoods are included to a variable usable diameter with a minimum of 4 inches. The volume shown under "Sound and rotten cull trees" includes the timber cruiser's estimate of the recoverable sound portion of such trees. Deduction from the volume is made for woods cull, that is, that part of the tree that would be left in the woods because of rot, fire-scar, crook, bad knots, or other defects. In presenting these data on the sound material in cull trees and in the top stems of sawlog trees, it should be noted that no estimate is made of the extent to which such material can or will be used for pulp, fuel, or other uses. Although the sound material is there, it may not be economically feasible to use it.

The pine volume shown is composed of loblolly and shortleaf pine; trees less than 9 inches in diameter make up a quarter of the total pine volume. The pulping hardwood species include red gum, black gum, tupelo gum, bay, and maple; red gum is by far the most important species from the standpoint of volume. Cypress is also included with the pulping hardwoods because it can be pulped, even though at present it is not generally used. Nearly 8 million cords of pulping hardwoods are in cull trees and tops of sawlog-size trees. The oaks are the most important nonpulping hardwoods, but hickory, elm, and ash are also prevalent. In the nonpulping hardwoods, 15 million cords of material in tops of sound trees and in cull trees will be available for use when suitable utilization processes are developed.

Table 5. - Net volume of all sound material, expressed in cords

Species group	Source of material				Total all classes	Percent of total
	Sound trees sawlog size	Tops of sawlog-size trees	Sound trees under sawlog size	Sound and rotten cull trees		
	Cords					
Pines	26,851,100	4,878,300	11,620,300	483,200	43,832,900	40.6
Hardwoods:						
Pulping	6,656,500	3,432,000	7,457,400	4,407,400	21,953,300	20.3
Nonpulping	11,747,400	6,663,400	15,418,400 1/	8,372,200	42,201,400	39.1
Total hardwoods	18,403,900	10,095,400	22,875,800	12,779,600	64,154,700	59.4
Total all species	45,255,000	14,973,700	34,496,100	13,262,800	107,987,600	100.0
Percent of total	41.9	13.9	31.9	12.3	100.0	

1/ Includes scrub oak volume.

The cordwood volume classified according to species group and diameter of trees is shown graphically in figure 2. Although the volume shown here does not include cull trees or tops and limbs of sawlog-size hardwood trees, it does include all sound trees to the limits described above.

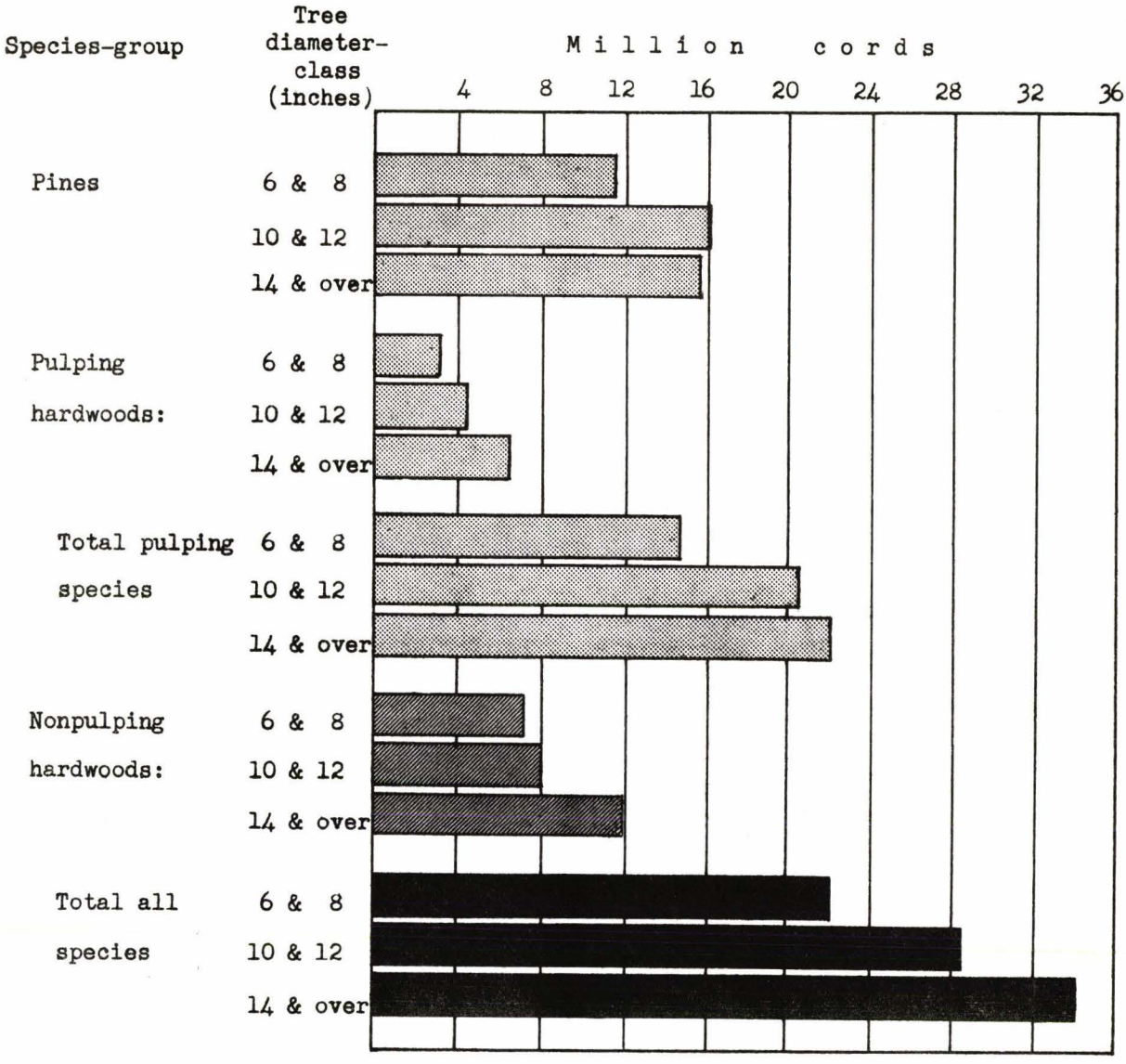

Figure 2. - Cordwood volume of pulping and nonpulping species

In table 6 is given the cordwood volume in sound trees on the average acre of the various forest conditions in each type-group. This cordwood volume, which includes only the stemwood of sound trees to a flexible 4-inch top diameter in all pines and in hardwoods under sawlog-size, and the merchantable sawtimber of sawlog-size hardwoods, is further separated into pines, pulping hardwoods, and nonpulping hardwoods. The average stands per acre were obtained by dividing the total volume of wood for a given type and forest condition by the total number of acres in that classification. The resulting values, therefore, are somewhat generalized but may be used for approximating cordwood volumes on large areas, where the areas in the various types and forest conditions have been determined.

Table 6. - Net cordwood volume on the average acre, classified according to type-group, species-group, and forest condition

Type-groups and species-groups therein	Old growth		Second growth			Clear-cut and reproduction	Weighted average
	Uncut	Partly cut	Sawlog size		Under sawlog size		
			Uncut	Partly cut			
	Cords						
Pure pine type-group:							
Pines	30.0	16.2	17.4	11.2	4.6	-	14.2
Pulping hardwoods	1.6	0.5	1.1	0.9	0.2	-	1.0
Nonpulping hardwoods	3.5	3.1	2.5	2.2	0.4	-	2.2
Total species	35.1	19.8	21.0	14.3	5.2	-	17.4
Pine hardwood type-group:							
Pines	15.6	10.6	9.0	6.2	1.6	0.2	6.3
Pulping hardwoods	3.6	3.0	2.9	2.4	0.7	(1/)	2.1
Nonpulping hardwoods	8.5	6.1	5.8	4.9	1.5	-	4.4
Total species	27.7	19.7	17.7	13.5	3.8	0.2	12.8
Upland hardwood type-group:							
Pines	2.1	1.8	1.2	0.8	0.2	(1/)	0.7
Pulping hardwoods	2.3	2.9	2.9	2.6	0.6	(1/)	1.7
Nonpulping hardwoods	9.4	7.7	7.4	6.0	2.6	(1/)	4.8
Total species	13.8	12.4	11.5	9.4	3.4	(1/)	7.2
Bottomland hardwood type-group:							
Pines	0.6	0.5	0.2	0.3	0.1	-	0.3
Pulping hardwoods	7.1	5.5	6.4	5.5	2.2	-	5.3
Nonpulping hardwoods	13.3	9.5	8.5	7.1	3.4	0.2	8.3
Total species	21.0	15.5	15.1	12.9	5.7	0.2	13.9
Average of all type groups: 2/							
Pines	6.6	3.2	11.5	6.8	1.6	0.1	7.1
Pulping hardwoods	5.1	4.3	2.5	2.3	0.8	(1/)	2.3
Nonpulping hardwoods	10.8	8.3	4.6	4.2	1.9	(1/)	4.5
Total species	22.5	15.8	18.6	13.3	4.3	0.1	13.9

1/ Negligible.
2/ Represents the average over the total forest area.

Pine poles and piles

An estimate of the number of pine poles and piles that will meet standard specifications is shown in table 7 by length and tree diameter, but because of the recognized difficulty of judging the suitability of standing trees for poles or piles, the estimate given here is conservative and likely to be short of the actual number found in the Unit. More reliable is the indication of the proportion of lengths and sizes occurring in the forest stands. It should be noted also that these poles and piles are included in the volume estimates shown in previous tables.

Table 7. - Total number of pine poles or piles, classified according to length and diameter

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Percent of total
	20	25	30	35	40	45	50 or over		
Inches	Thousand sticks								
7.0- 8.9	5,494	2,676	625	148	32	-	-	8,975	32.8
9.0-10.9	3,681	2,798	1,862	654	325	-	-	9,320	34.0
11.0-12.9	1,324	1,356	1,570	564	377	187	29	5,407	19.7
13.0-14.9	338	438	857	361	287	148	138	2,567	9.4
15.0-16.9	32	74	303	151	158	106	110	934	3.4
17.0-18.9	-	-	26	45	48	39	29	187	0.7
Total	10,869	7,342	5,243	1,923	1,227	480	306	27,390	100.0
Percent of total	39.7	26.8	19.1	7.0	4.5	1.8	1.1	100.0	

Forest Increment Within the Unit

Individual trees increase in volume from year to year only when the volume added through growth exceeds that lost through decay. The increment of a forest stand is the net volume (added periodically) due to increase in the volume of the trees in the stand (i.e., with mortality losses deducted) plus that added by the accession of new trees from the smaller diameter-classes. Forest increment, therefore, represents the cut which can be made periodically without reducing the volume represented by the original growing stock.

Current annual increment percent

In table 8 is given the increment rates of pines and hardwoods in the various forest conditions during 1936, which may not necessarily hold as the average for a given 10-year period. The increment rate in the under-sawlog-size condition is exceptionally high because of the large volume of trees recruited into the stand from saplings during the year.

Table 8. - Rate of increase (current annual increment) of stands in the various forest conditions, 1936

Forest condition	Pines		Hardwoods	
	Board feet	Cubic feet	Board feet	Cubic feet
	Percent			
Old growth:				
Uncut	2.8	2.6	2.3	1.8
Partly cut	5.2	5.0	4.2	3.0
Second growth:				
Sawlog size:				
Uncut	6.8	4.9	5.8	4.2
Partly cut	6.4	4.0	6.2	3.9
Under sawlog size	57.3	15.4	24.4	7.2
Reproduction	9.2	8.9	7.7	6.4
Weighted averages	7.0	5.1	5.1	3.9

Increment per acre

The increment percents, as given in table 8, may be multiplied by the average volume per acre to arrive at the increment per average acre during 1936. In table 9 the increment per acre in the various forest conditions is expressed in board feet and cords. Since the increment shown here includes growth on that portion of the stand that would normally be removed as utilization drain, to this extent it is higher than the actual increment per acre during that year. The per-acre board-foot volumes from which increment is computed include only sawtimber material, while cordwood volumes include sawtimber, trees under sawlog-size, and upper stems of sawlog-size pine trees.

Table 9. - Increment on the average acre in the various forest conditions, 1936

Forest condition	Pines		Hardwoods	
	Board feet	Cords	Board feet	Cords
Old growth:				
Uncut	74	.17	118	.29
Partly cut	58	.16	139	.38
Second growth:				
Sawlog size:				
Uncut	217	.56	67	.30
Partly cut	116	.27	59	.25
Under sawlog size	63	.25	22	.19
Reproduction	(1/)	(1/)	(1/)	(1/)
Weighted averages	135	.36	63	.27

1/ Negligible.

Forest increment

Table 10 shows the net volume of wood added to the sound-tree inventory during 1936, expressed in board feet and in cubic feet. In arriving at this estimate, corrections were made for mortality and for growth on those trees that were removed from the stand for utilization throughout the year. The volume expressed in board feet is increment of sawtimber only, while the volume expressed in cubic feet includes increment in sawtimber, in material in trees under sawlog size, and in upper stems of sawlog-size pine trees. Increment in board-foot material is expressed in lumber tally, as measured by the International $\frac{1}{4}$-inch rule.

The increment on the 19 billion feet inventory (International $\frac{1}{4}$-inch rule) was 1,169,200,000 feet in 1936. Of this total increment, 13 percent was in old-growth stands averaging 5,780 board feet per acre and 78 percent was in second-growth sawlog-size stands that averaged 3,760 board feet per acre. Of the total increment, 103 million board feet, or 9 percent, occurred in under-sawlog-size stands with a volume of less than 400 feet per acre as of January 1, 1936.

When considering the effect of the quality of the increment on its utilization, it should be recalled that since the removal of the original timber the land has restocked to second growth on 87 percent of the forest area. The quality of this second-growth timber is obviously not as good as that of the old-growth stands, but a field canvass of the sawmills operating in the unit showed that all of the mills cutting under 20 thousand board feet per day were using second growth entirely. Mills in the 20 to 79 thousand-foot class were cutting 97 percent second growth, and mills cutting over 80 thousand feet were using 40 percent second growth. Two of the largest mills in the Unit, which are cutting 40 percent second growth, are on a recognized sustained-yield basis. One of these mills is operating on the basis that as little as 500 board feet per acre can be logged at a profit, and many other mills are logging stands as light as this where they are intermixed with better stands.

Table 10. - Forest increment in board-feet and in cubic-feet in the various forest conditions, 1936

Forest condition	Sawtimber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	- - Thousand board feet - -			- - Thousand cubic feet - -		
Old growth	48,500	103,200	151,700	11,380	21,380	32,760
Second growth:						
Sawlog size	675,400	238,700	914,100	153,590	85,060	238,650
Under sawlog size	75,800	27,400	103,200	29,270	20,480	49,750
Reproduction	100	100	200	50	20	70
Total all conditions	799,800	369,400	1,169,200	194,290	126,940	321,230

The cubic-foot increment shown in table 10 is expressed in cords in table 11.

Table 11. - Forest increment expressed in cords in the various forest conditions, 1936

Forest condition	Pine	Hardwood	Total
	- - - - - - - - - - - - - - - Cords - - - - - - - - - - - - - - -		
Old growth	126,500	267,200	393,700
Second growth:			
Sawlog size	1,706,500	1,063,300	2,769,800
Under sawlog size	325,300	256,000	581,300
Reproduction	500	300	800
Total all conditions	2,158,800	1,586,800	3,745,600

Sawmills

Table 12 shows the approximate number of sawmills in the Unit during 1936, as well as the number of man-days of labor required in logging and operating these mills. With improving conditions in the lumber industry, there has been a gradual increase in the number of sawmills operating in this area. Most noticeable is the increase in the number of pine mills cutting 20 to 39 thousand board feet per day. Equipped with machinery for manufacturing finished lumber and buying logs hauled in by truck, these mills typify the trend from operators of immobile units, dependent upon large ownerships of virgin timber, to small operators owning little, if any, timber and buying logs upon the open market.

Table 12. - Number of sawmills and extent of employment, classified according to size-class of mill, 1936

Daily (10 hrs.) rated capacity 1/ in M board feet	Number of mills 2/			Thousand man-days of employment		
	Pine	Hardwood	Total	Woods	Mill	Total
Under 20	354	32	386	172	313	485
20 - 39	50	4	54	150	242	392
40 - 79	3	2	5	61	58	119
80 and over	8	1	9	185	413	598
Total	415	39	454	568	1,026	1,594

1/ The rated capacity indicates size of mill rather than actual average daily capacity.
2/ The data given here on the number of mills in the smallest class are only estimates based upon all available records and were not checked by actual count, but the figures for the larger mills are based upon field counts as well as upon records.

Other forest industries

In addition to the 454 sawmills in the Unit during 1936, there were 2 treating plants, 2 veneer plants, 6 cooperage plants, 12 handle plants, and 17 plants producing shingles, excelsior, furniture squares, pulp, and hardwood distillation products (fig. 3). Early in 1937, a new pulp mill with a daily capacity of 150 tons of sulphate pulp began operations at Crossett. The production of crossties, poles and piles, fuelwood, and fence posts is an important activity and provides employment to many workers. A summary of the production and employment data in the various forest industries is given in table 13.

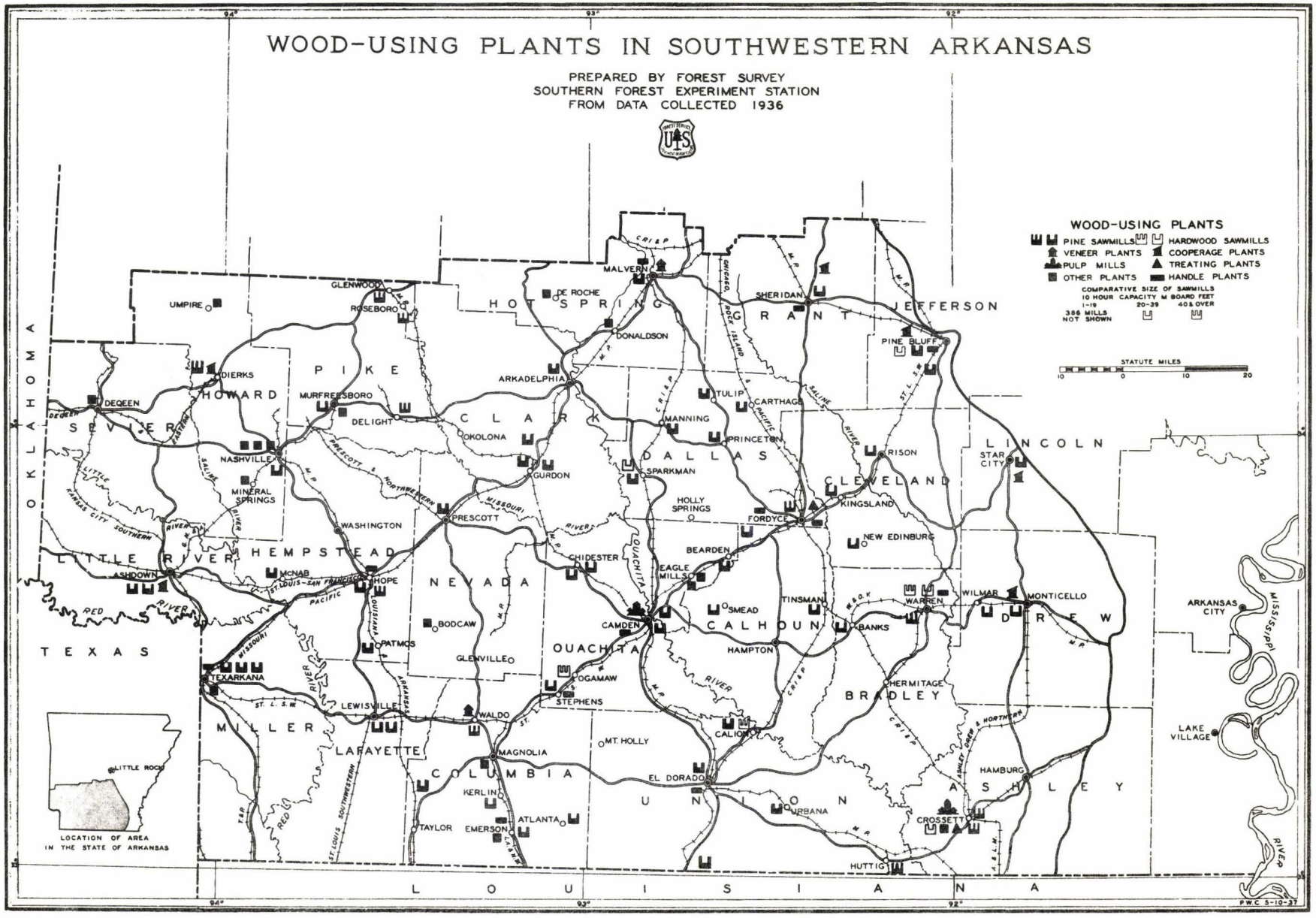
WOOD-USING PLANTS IN SOUTHWESTERN ARKANSAS
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
FROM DATA COLLECTED 1936
WOOD-USING PLANTS
PINE SAWMILLS
HARDWOOD SAWMILLS
VENEER PLANTS
COOPERAGE PLANTS
PULP MILLS
TREATING PLANTS
OTHER PLANTS
HANDLE PLANTS
COMPARATIVE SIZE OF SAWMILLS
10 HOUR CAPACITY M BOARD FEET
1-19
20-39
40& OVER
386 MILLS NOT SHOWN
STATUTE MILES
10 0 10 20
OKLAHOMA
TEXAS
LOUISIANA
MISSISSIPPI RIVER
HOWARD
PIKE
SEVIER
HOT SPRING
CLARK
GRANT
JEFFERSON
DALLAS
CLEVELAND
LINCOLN
LITTLE RIVER
HEMPSTEAD
NEVADA
OUACHITA
CALHOUN
DREW
BRADLEY
ASHLEY
MILLER
LAFAYETTE
COLUMBIA
UNION
UMPIRE
GLENWOOD
ROSEBORO
MALVERN
DE ROCHE
SHERIDAN
DONALDSON
PINE BLUFF
DIERKS
ARKADELPHIA
DEQUEEN
MURFREESBORO
DELIGHT
TULIP
CARTHAGE
MANNING
PRINCETON
OKOLONA
RISON
STAR CITY
NASHVILLE
MINERAL SPRINGS
GURDON
SPARKMAN
HOLLY SPRINGS
KINGSLAND
FORDYCE
WASHINGTON
PRESCOTT
NEW EDINBURG
CHIDESTER
BEARDEN
EAGLE MILLS
ASHDOWN
MCNAB
HOPE
WILMAR
WARREN
MONTICELLO
ARKANSAS CITY
SMEAD
TINSMAN
BODCAW
CAMDEN
BANKS
PATMOS
HAMPTON
GLENVILLE
TEXARKANA
OGAMAW
HERMITAGE
LEWISVILLE
STEPHENS
WALDO
CALION
MT. HOLLY
MAGNOLIA
EL DORADO
LAKE VILLAGE
HAMBURG
KERLIN
URBANA
CROSSETT
TAYLOR
EMERSON
ATLANTA
HUTTIG
LITTLE ROCK
LOCATION OF AREA
IN THE STATE OF ARKANSAS
PWC 5-10-37

Figure 3

Table 13. - Production and employment data, 1936

Kind of plant or commodity	Number of plants	Amount produced or used	Employment		
			Woods	Mill	Total
			- - - - Thousand man-days - - - -		
		M bd. ft.			
Sawmills	454	563,800	568	1,026	1,594
Veneer	2	3,700	18	15	33
		M cu. ft.			
Treating plants	2	170	-	2	2
		M pieces			
Crossties	-	3,378	471	-	471
Poles and piles	-	131	35	-	35
Fence posts	-	3,898	51	-	51
		M cords			
Cooperage	6	22	43	44	87
Handles	12	9	22	22	44
Fuelwood	-	1,000	1,036	-	1,036
Miscellaneous 1/	17	149	190	152	342
Total	493	-	2,434	1,261	3,695

1/ Includes 12 shingle mills, 1 excelsior plant, 2 furniture-square mills, 1 pulp mill, and 1 hardwood-distillation plant.

Employment

As shown in table 13, the total employment furnished by forest utilization industries in 1936 amounted to 3,695,000 man-days. Forty-three percent of this was furnished by the sawmill industry, while 28 percent of the total labor was required for the production of fuelwood consumed within the Unit. Assuming a wage of $1.50 per man-day, the forest industries distributed $3,912,000 in wages to people within the area. If the fuelwood and fence posts for home consumption were produced by wage earners, an additional $1,630,500 would be earned.

Utilization Drain

In order to compare the utilization of forest commodities with the productive capacity of a forest, it is necessary to establish the annual drain on the growing stock of sound trees. This drain includes all material cut and utilized, as well as any incidental drain in sound material left in the forest as a result of cutting. It does not include material cut from limbs or from cull or dead trees. The first three columns of figures in table 14 show the drain in board feet, both direct and incidental, that came from that part of the tree classified as sawtimber. The last three columns show the drain in cubic feet on sawtimber material, on material in small trees, and in the upper stems of pine trees of sawlog size.

Table 14. - Utilization drain from sound trees, 1936

Commodity	Sawtimber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	- - Thousand board feet - -			- - Thousand cubic feet - -		
Lumber	432,100	153,200	585,300	93,760	25,790	119,550
Crossties	121,700	69,500	191,200	25,810	12,350	38,160
Poles and piles	13,900	600	14,500	3,120	150	3,270
Veneer	700	9,900	10,600	140	2,100	2,240
Cooperage	200	24,800	25,000	60	4,190	4,250
Misc. manufactures	300	7,000	7,300	260	1,580	1,840
Pulpwood	25,700	-	25,700	9,280	-	9,280
Fuelwood	50,800	51,700	102,500	24,600	19,540	44,140
Fence posts	-	7,300	7,300	160	2,100	2,260
Misc. farm use	26,200	11,400	37,600	9,450	4,750	14,200
Total	671,600	335,400	1,007,000	166,640	72,550	239,190

Comparison of Increment and Drain

To evaluate the forest situation more accurately, a comparison of forest increment and utilization drain for 1936 is given in tables 15 and 16. Table 15 compares the net sawtimber increment with the utilization drain of sawtimber, as expressed in the International $\frac{1}{4}$-inch rule, which closely approximates green lumber tally.

Table 15. - Balance between increment and drain in board feet
(International $\frac{1}{4}$-inch rule)

	Pines	Hardwoods	Total
	- - - - - Thousand board feet - - - - -		
Net growing stock, January 1, 1936	11,805,000	7,527,500	19,332,500
Growth, 1936	851,800	444,900	1,296,700
Mortality, 1936	52,000	75,500	127,500
Forest increment, 1936	799,800	369,400	1,169,200
Utilization drain, 1936	671,600	335,400	1,007,000
Net increase in growing stock, 1936	128,200	34,000	162,200
Net growing stock, January 1, 1937	11,933,200	7,561,500	19,494,700

As shown in table 15, the forest increment exceeds the utilization drain by 128 million board feet in the pines and by 34 million feet in the hardwoods. The total commodity drain on old-growth pine stands is approximately 188 million board feet, compared with an increment of 48 million; while in the hardwoods the total drain on old-growth stands is 130 million board feet, compared with an increment of 103 million. It follows that the old-growth timber is being rapidly harvested, and since the supply of old growth is definitely limited, the larger bodies of such timber soon will be exhausted and the supply reduced to scattered remnants. In the second-growth stands, however, there is an excess of board-foot increment over drain of 268 million feet in pine and of 60 million feet in hardwoods. This would seem to indicate that, while the excess of increment over drain is no more than is needed as a margin of safety to build up the growing stock, there will be an opportunity for a greater drain in the future, owing (1) to the rapid replacement of slow-growing old-growth stands with rapid-growing young timber and (2) to the annual accumulation of an uncut surplus of increment on the extensive second-growth stands in the region.

A comparison of increment and drain, with volumes expressed in cubic feet, is given in table 16. The forest increment of 321 million cubic feet exceeded the utilization drain by 82 million cubic feet. This total increment is as available for utilization as the total volume of growing stock described under "Volume estimates", with the possible exception of 20 million cubic feet of increment in the upper stems of sawlog-size pines. Rational use of the forest resource dictates, however, that the 25 million cubic feet of pine, 43 percent of which was from sawlogs, used for fuelwood in 1936, should most properly come from this class of material. In the pines, drain was 86 percent of the increment, while in the hardwoods it was only 57 percent of the increment.

Table 16. - Balance between increment and drain in cubic feet

	Pines	Hardwoods	Total
	- - - - - Thousand cubic feet - - - -		
Net growing stock, January 1, 1936	3,901,480	3,303,670	7,205,150
Growth, 1936	227,720	171,050	398,770
Mortality, 1936	33,430	44,110	77,540
Forest increment, 1936	194,290	126,940	321,230
Utilization drain, 1936	166,640	72,550	239,190
Net increase in growing stock, 1936	27,650	54,390	82,040
Net growing stock, January 1, 1937	3,929,130	3,358,060	7,287,190

Outlook for the Future

The forest resources in southwest Arkansas seem to augur a favorable future for the communities and industries dependent thereon. The forest area of the unit is extensive, covering 68 percent of the land surface, and is well stocked with stands of fast-growing trees, for the many diversified commodities of which there exists a well-established market. The forest, the terrain, the climate, and the labor conditions are such that logging and transportation costs are relatively low. The annual increment of the forest, if used with a degree of restraint and a common-sense regard for the principles of forest cropping, probably can maintain indefinitely an annual harvest of forest products fully equal in volume to the 1936 drain without reducing the basic growing stock.

The growing demand for the forest products of the region will tend to reduce the favorable margin existing in 1936 between increment and drain and will thus prevent the increase in the growing stock that is essential if the forests are to be utilized to their full producing capacity. Calculations show that at least for the next 10 years not more than 80 percent of the indicated annual increment should be harvested annually, if the growing stock is to be increased to allow an expansion of industrial development. With an addition of 20 percent of the increment each year to the growing stock, by 1946 the area should produce an increment of 1,360 million board feet as against the present annual increment of 1,170 million feet; and during the same period the annual cut could be increased from 1,010 million board feet in 1936 to an annual cut in 1947 and thereafter of 1,360 million feet if the full amount of the increment were taken.

The system of fire protection that the State Forest Service, with the cooperation of the Federal Government, has developed in recent years has al-

ready had a notably beneficial effect. It should, however, be strengthened and extended to every part of the Unit, because continued and complete prevention of fire will reduce the mortality, speed up the growth, and increase the increment per acre of practically every forest stand in the area.

The exercise of the necessary restraint in regulating the cut would be comparatively easy if the forest lands of the Unit were all under one ownership or control, but this is not the case. The timber lands are owned by many thousands of proprietors with many and diverse motives actuating their management policies, and to achieve the region-wide objective each one of these owners must act in accord with the general policy. Obviously a greatly extended campaign of education, demonstration, and perhaps actual aid is necessary, in which public and quasi-public agencies must take the field in force.

Although the existence of a good market for all classes of forest products, coupled with good growing conditions, makes this one of the most favorable regions in the South for profitable forest management under private ownership, one of the disquieting aspects of the future outlook, as small mills replace larger ones and pulp mills replace both, and as second-growth timber displaces old growth in the cut, is the marked trend to reduce the minimum diameter of the trees cut. This practice results in reducing materially the quality and consequently the unit value of the products harvested. This same trend is found throughout the South and foretells a gradual but inevitable revolution in the character of the forest industries. In other words, while the forest situation justifies the belief that the future output of wood can be maintained at least at the 1936 level, it is more than likely that the high-grade material that can come only from large trees will gradually be replaced by low-grade lumber, small poles, ties, and pulpwood. This can be prevented only through a very considerable increase in the number of acres that private owners are willing to put under long-time management for high-grade sawtimber.